

# Variation in Hip Fracture Treatment: Are Black and White Patients Treated Equally?

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## Abstract

To examine disparity in race for hip fracture treatment, we identified femoral neck fractures and pertrochanteric fractures from a 20% sample of 1999–2003 Medicare part B claims data and stratified patients by treatment: total hip arthroplasty (THA), hemiarthroplasty (HA), open reduction and internal fixation (ORIF), and nonoperative management (NM). Covariables included patient race, age, sex, and Charlson Comorbidity Index score. The geographic variable was the hospital referral region (306 such US regions are defined in *The Dartmouth Atlas of Health Care*). Logistic regression was performed to evaluate the independent effect of each variable on treatment received.

There were 49,755 femoral neck fractures (94% white patients) and 90,440 pertrochanteric fractures (94% white). For femoral neck fractures, no significant differences were found by race ( $P = .16$ ) in adjusted mean rates for THA (2.73%), HA (77.8%), ORIF (26.9%), or NM (2.95%). For pertrochanteric fractures, no significant differences were found by race ( $P = .09$ ) in adjusted mean rates for THA (0.47%), HA (8.24%), ORIF (94.8%), or NM (2.11%).

There were no significant disparities by race across hospital referral regions with regard to type of fracture treatment.

**H**ip fractures are the most common fractures in the Medicare population; they account for 45% of all fractures in this older population.<sup>1</sup> However, there is significant geographic variation in hip fracture rates, with a national high of

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10.7/1000 patients in Rome, Georgia, versus a low of 4.9/1000 in Honolulu, Hawaii.<sup>2</sup> The medical literature is replete with articles about racial disparities in disease prevalence, diagnostic workup, and access to and delivery of medical care.<sup>3-7</sup> Many of these issues have been documented in the orthopedic literature. Specifically, there are differences in rates of hip and knee arthroplasty, back surgery, and osteoporotic medical evaluation and treatment.<sup>8-11</sup> As a nation, we must address racial disparities in health care delivery with respect to fractures, which often require emergency care. The study described in this article is the first to examine hip fracture treatment by race and to explore whether the traditional racial differences in health care exist for this most common of fractures.

In the orthopedic literature, most examples of racial disparity involve elective, nonacute cases. Conversely, there is a paucity of data on the role of racial and ethnic variation in the treatment of nonelective, trauma-related conditions.

The purpose of this study was to examine the role of racial and ethnic variation for a nonelective orthopedic condition. More specifically, we examined the Medicare population to understand if there was a difference in hip fracture treatment between racial and ethnic groups.

Our null hypothesis was that there would be no differences between groups in the rates of total hip arthroplasty (THA), hemiarthroplasty (HA), open reduction and internal fixation (ORIF), and nonoperative management (NM) after femoral neck or pertrochanteric hip fracture. Furthermore, we hypothesized that there would be no pockets of racial or ethnic disparity in hip fracture treatment within US regions. These hypotheses were based primarily on the hypothesis that the nonelective and urgent nature of hip fractures would minimize the roles that cultural and ethnic issues often have in other medical conditions.

## MATERIALS AND METHODS

A random 20% sample of the National Medicare Claims Part B database, 1999 to 2003, was searched for femoral neck fractures (820.0, *Orthopaedic International Classification of Diseases, Ninth Revision*) and pertrochanteric fractures (820.2). From this cohort, we further classified patients by Current Procedural Terminology codes for THA (025-27130), HA (025-27236), ORIF

**Table I. Cohort Demographics**

Parameter	Total Cohort	Fracture Group	
		Femoral Neck	Petrochanteric
Patients (n)	140,195	49,755	90,440
Mean age (y)	82.6	82.5	83.6
Sex (%)			
Female	76.2	76.9	77.0
Male	23.8	23.1	23.0
Race (%)			
White	92.8	94.5	93.9
Black	4.0	3.3	3.2
Other	3.3	2.2	3.0
Charlson Comorbidity Index score (%)			
0	57.7	45.9	45.3
1	25.7	34.3	34.7
2	9.9	12.5	12.8
3+	6.7	7.4	7.1

(pinning, 025-27235; compression screw, 025-27244; intramedullary nailing, 025-27245), and NM (025-27230, 025-27232, 025-27238, 025-27240).

Hospital referral region (HRR), which represents a health care market for tertiary medical care, was the geographic variable. (HRRs are 306 distinct US regions as defined in *The Dartmouth Atlas of Health Care*.<sup>12</sup>) Postal code regions were assigned to local hospitals, based on where the plurality of residents was hospitalized, to form hospital service areas, which were further aggregated into HRRs based on where most residents received major cardiovascular and neurosurgical procedures. A complete description of the methods for defining HRRs has been published.<sup>13</sup>

**Statistical Methods**

Rates of each procedure type were compared across racial and ethnic groups (white, black, other) and by HRR. Rates were adjusted for age, sex, and Charlson Comorbidity Index score.<sup>14</sup> Logistic regression models were used to evaluate for differences in receipt of each treatment by race while controlling for age, sex, and HRR.

**RESULTS**

The cohort included 140,195 patients: 49,755 with a femoral neck fracture and 90,440 with a petrochanteric fracture (Table I). Of the entire cohort, 76% were women (mean age, 83 years), and 93% were white (7.3%, nonwhite).

In the femoral neck fracture group, mean age was 82.5 years, 76.9% of patients were women, and 47,012 (94.5%) of patients were white. These fractures were treated with HA (78%), ORIF (27%), THA (3%), and NM (3%). A few beneficiaries had codes for 2 different treatments; thus, proportions add up to slightly more than 100%. In this group, white and nonwhite patients did not differ with respect to treatment (Table II): HA (white, 78%; nonwhite, 78%), ORIF (white, 27%; nonwhite, 27%), THA (white, 2.7%; nonwhite, 2.8%), NM (white, 2.9%; nonwhite, 3.4%). Race was not a predictor of treatment in a logistic regression model after controlling for age, sex, and Charlson score ( $P = .16$ ).

In the petrochanteric fracture group, mean age was 83.6 years, 77.0% of patients were women, and 84,882 (93.9%) of patients were white. In this group, white and nonwhite patients did not differ with respect to treatment (Table III): ORIF (white, 90%; nonwhite, 90%), HA (white, 8.2%; nonwhite, 8.7%), NM (white, 2%; nonwhite, 2%), THA (white, 0.47%; nonwhite, 0.49%). In the ORIF group, there was no difference between patients who received sliding hip screws (white, 76.0%; nonwhite, 75.9%) and patients who received cephalomedullary nails (white, 14.4%; nonwhite, 14.5%). A few beneficiaries had codes for 2 different treatments; thus, proportions add up to slightly more than 100%. Race was not a significant

**Table II. Treatment of Femoral Neck Fractures**

Race	THA	HA	ORIF	NM
White	2.7%	77.8%	26.9%	2.9%
Nonwhite	2.8%	77.7%	26.9%	3.4%

Abbreviations: THA, total hip arthroplasty; HA, hemiarthroplasty; ORIF, open reduction and internal fixation; NM, nonoperative management.

**Table III. Treatment of Petrochanteric Fractures**

Race	THA	HA	Sliding Hip Screw	Cephalomedullary Nail	NM
White	0.5%	8.2%	76.0%	14.4%	2.1%
Nonwhite	0.5%	8.8%	75.9%	14.3%	2.0%

Abbreviations: THA, total hip arthroplasty; HA, hemiarthroplasty; NM, nonoperative management.

**Table IV. Results of Logistic Regression Model of Hemiarthroplasty for Femoral Neck Fractures**

Parameter	Model With Hospital Referral Region			Model Without Hospital Referral Region		
	OR	95% CI	P	OR	95% CI	P
White	0.92	0.84, 1.02	.11	0.93	0.85, 1.03	.15
Female	0.98	0.93, 1.03	.35	0.97	0.92, 1.02	.21
Age (y)						
65–69	Reference	—	—	Reference	—	—
70–74	0.88	0.78, 0.98	.03	0.88	0.79, 0.99	.03
75–79	0.79	0.71, 0.87	<.01	0.79	0.71, 0.87	<.01
80–84	0.74	0.67, 0.82	<.01	0.74	0.67, 0.82	<.01
>84	0.66	0.60, 0.73	<.01	0.67	0.60, 0.74	<.01

**Table V. Results of Logistic Regression Model of Open Reduction and Internal Fixation for Pertrochanteric Fractures**

Parameter	Model With Hospital Referral Region			Model Without Hospital Referral Region		
	OR	95% CI	P	OR	95% CI	P
White	0.90	0.79, 1.03	.12	0.89	0.79, 1.02	.08
Female	0.99	0.92, 1.07	.84	0.98	0.91, 1.06	.64
Age (y)						
65–69	Reference	—	—	Reference	—	—
70–74	1.05	0.87, 1.26	.65	1.04	0.86, 1.25	.71
75–79	1.04	0.87, 1.24	.66	1.03	0.86, 1.22	.76
80–84	1.04	0.88, 1.23	.65	1.03	0.87, 1.21	.77
>84	0.99	0.84, 1.16	.89	0.98	0.83, 1.15	.78

**Table VI. Regional Comparisons for Pertrochanteric Fractures**

Region	ORIF for Pertrochanteric Fractures			HA for Femoral Neck Fractures		
	White	Black	Difference	White	Black	Difference
New Orleans, LA	99.3%	88.9%	10.4%	82.9%	92.9%	10.0%
Jackson, MI	95.2%	97.6%	2.4%	73.4%	86.4%	13.0%
Dallas, TX	91.7%	84.6%	7.1%	79.5%	84.0%	4.5%

Abbreviations: ORIF, open reduction and internal fixation; HA, hemiarthroplasty.

predictor of treatment in a logistic regression model after controlling for age and sex ( $P = .09$ ).

The cohort was next stratified by HRR. For each treatment modality, the percentage of whites and nonwhites undergoing a particular surgical intervention was investigated. No significant differences were found between race and fracture treatment across regions. Logistic regression models controlling for age, sex, race, and HRR were created. For each treatment, analysis used a model that included HRR and a model that did not include HRR. All models failed to show a significant contribution of race to the treatment patterns. The regression models for the 2 most common treatments are shown in Table IV (HA for femoral neck fractures) and Table V (ORIF for pertrochanteric fractures). These tables highlight the lack of a difference made by HRR between models. Because all regions were included in the regression model, the precise data from each of the 306 regions were not included in the table.

## DISCUSSION

It has been well documented that race and ethnicity play a critical role in health care variation. Multiple studies have

demonstrated striking disparities in many medical and surgical treatments between sexes, races, ethnicities, and regions. These studies often involved elective treatments for conditions in which more than one treatment option was available (eg, cardiac disease, spine surgery, total joint arthroplasty). Results from the present study showed that a very different paradigm exists in hip fracture treatment. For this condition, there is consensus that surgery is the best, evidence-based treatment option. Thus, it is well accepted that all but the most medically unwell patients undergo surgical intervention. In fact, in both femoral neck and pertrochanteric fractures, a consistent proportion of patients received THA, HA, and ORIF regardless of race. This equality was consistent in all 306 HRRs across the United States.

As operative treatment is performed in virtually all cases, surgeon, patient, and family engage in emergency room conversations about the options of the best treatment plans for these common fractures. Treatment of femoral neck fractures has been well studied, and it is widely accepted that displaced femoral neck fractures benefit from arthroplasty (either THA or HA),<sup>15,16</sup> as

reflected in the fact that almost 80% of patients undergo arthroplasty, regardless of race or region. Patients who had ORIF performed likely had nondisplaced fractures or were too medically unstable to undergo a larger operation, but the database was limited in its ability to decipher this. In patients with pertrochanteric fractures, approximately 90%, again regardless of race or region, underwent ORIF, the gold standard for this fracture pattern. In the United States, the shift from sliding hip screws to cephalomedullary nails was just beginning when this cohort (1999–2003) was being followed. Although there is a discrepancy in the treatment of each fracture, this discrepancy appears to be consistent across the United States and across races. That is, the same concerns about how best to address a displaced basicervical femoral neck in Boston, Massachusetts, exist in Boston, Indiana, regardless of race.

The racial and geographic variations in incidence of hip fractures are well documented,<sup>17,18</sup> but the literature has scant data on the variation in treatment of these fractures. Lu-Yao and colleagues<sup>19</sup> investigated mortality rates by sex in hip fracture patients and found a similar and constant ratio of surgical treatment between whites and blacks for femoral neck fractures (ORIF, 95.1% whites; arthroplasty, 94.6%; other interventions, 91.8%) and other hip fractures (ORIF, 95.3% whites; arthroplasty, 94.2%; other interventions, 94.1%). We found the same pattern in our study. Examining the role of race in the treatment of selected pediatric fractures, Slover and colleagues<sup>20</sup> found no racial differences in treating forearm and femur fractures but did find a difference in treating supracondylar fractures.

With regard to regional variation, our findings are in contrast to literature examining both racial and geographic disparities in elective situations. Skinner and colleagues<sup>10</sup> found significant discrepancies among whites, blacks, and Hispanics in total knee arthroplasties (TKAs) across the United States and identified many pockets of discrepancy, with 3 cities in particular—New Orleans, Louisiana; Dallas, Texas; and Jackson, Michigan—showing significant differences in TKA rates (Table VI). In New Orleans, the rate was 1.2 TKAs per 1000 blacks versus 3.4 TKAs per 1000 non-Hispanic whites; in Dallas, the rate was 1.5 TKAs for blacks versus 4.4 TKAs for non-Hispanic whites; in Jackson, the rate was 1.0 TKA for blacks versus 3.4 TKAs for non-Hispanic whites. There was considerably less racial variation in these cities in the traumatic, nonelective, evidence-based scenario of a hip fracture. It appears that the economic, cultural, and social factors that have created a 3-fold or larger difference in TKA rates in these 3 cities have little effect when the surgical intervention is considerably less elective.

Our study limitations involve the inherent nature of database studies. Results are limited by quality and accuracy of data entry. Further, though we have controlled for Charlson score, we cannot completely account for

differences in underlying health status. Sicker and more debilitated patients may be more likely to receive less invasive fracture treatments, and the Charlson score may not completely correct for these differences. Also, this database cannot ascertain the types of implants used; thus, what may be missing are differences in the expense of the fixation devices used, as there is a wide spectrum of costs, even among HA implants.

## CONCLUSIONS

Our study is one of a few that have failed to show a difference across racial and ethnic groups. When a procedure is urgent or emergent, and the treatment options are well defined by evidence-based criteria and widely accepted, the cultural and socioeconomic issues that in part drive the disparities found in elective surgery may no longer be a factor. Access barriers, language difficulties, and cultural beliefs may be immaterial when a patient fractures a hip. This is an area in which the national and local community has maintained apparent equality in the delivery of health care services across races and regions. This study revealed that the widespread disparities in surgical and medical fields do not exist in orthopedic trauma treatment of the fractured hip, regardless of race or region. Further investigation of other common trauma conditions, within orthopedics and beyond, will add to our knowledge and may help us better understand the effect of race across a broader spectrum of medicine.

## AUTHORS' DISCLOSURE STATEMENT

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